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ABSTRACT

This report examines the state of the art of utilizing cost-benefit methodologies to evaluate the returns on investments in vocational education. The objectives and format of the report and the literature search methodology employed in it are outlined. Presented next is an overview of the diverse literature related to cost-benefit analysis, including discussions of literature relating to the economics of education, cost-benefit and educational evaluation theories, cost-benefit applications in vocational education, and vocational education data sources. A total of 32 abstracts of some of the major literature in each of these areas is provided. Included in the final section of the report are bibliographies of works in each of the areas. (Related reports on other components of the project and the final project report are available separately through ERIC--see note.) (MN)

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DESIGN OF A NATIONAL COST-BENEFIT STUDY OF VOCATIONAL EDUCATION AT THE SECONDARY, POSTSECONDARY AND ADULT LEVELS: STATE OF THE ART REPORT

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SECTION 1

INTRODUCTION

Cost-benefit analysis is one important method for improving resource allocation in the general area of social welfare. The Department of Education has contracted with Rehab Group, Inc. for a study assessing the feasibility of performing a national cost-benefit analysis of secondary, postsecondary, and adult vocational education. The components of this study include:

- An analysis of the measurement problems in performing a national cost-benefit study.
- An assessment of the state of the art in applying cost-benefit methodologies to vocational education.
- Recommendations concerning the feasibility of performing a national cost-benefit study.

Each of these study components is examined in a separate document. The reports are written as companion pieces utilizing similar format and terminology. In addition, a final report synthesizes the primary findings of all study areas into one document.

STATE OF THE ART REPORT OBJECTIVES

This report surveys the state of the art of utilizing cost-benefit methodologies to evaluate the returns on investment in vocational education. The primary objective of the paper is to identify and summarize existing cost-benefit studies of vocational education and the literature describing the theory and methodology of cost-benefit analysis. The identification and summarization process will illuminiate the strengths and weaknesses of existing cost-benefit designs. This information will play a primary role in accomplishing the remaining two objectives of this study: to identify the major problems in measuring vocational education costs and benefits and to determine the feasibility of performing a national cost-benefit analysis.

No systematic critical discussion of the strengths and weaknesses of the various cost-benefit designs reviewed in this report is undertaken at this time. This is accomplished in a separate document, Design of a National

Cost-Benefit Study of Vocational Education at the Secondary, Postsecondary and Adult Levels: Cost-Benefit Measurement Report. Similarly, no extensive conclusions are drawn in this paper on the utility of using any existing designs in a national cost-benefit study. These conclusions appear in Design of a National Cost-Benefit Study of Vocational Education at the Secondary, Postsecondary, and Adult Levels: Cost-Benefit Feasibility Report.

Therefore, the state of the art review of cost-benefit applications to vocational education serves two principal purposes. First, the results of the overview are summarized to provide a general understanding of the literature relevant to cost-benefit analysis of vocational education. Second, the overview procedure and results serve as part of the methodology to accomplish the remaining objectives of the project and form a basis for the other components of this study.

STATE OF THE ART REPORT FORMAT

The results of the literature review process are reported in four ways. First, an overview of the literature is presented. The overview summarizes the methodologies and findings of major literature on the theory and application of cost-benefit analysis. Second, selected outstanding pieces of literature are abstracted. The abstracts provide the reader with more in-depth information on some of the most influential literature in the field than can be provided in the overview. Third, a comprehensive bibliography of books, articles, monographs, reports, and unpublished dissertations and papers is furnished. Fourth, a glossary of terms used in the analysis of vocational education costs and benefits is included.

The body of literature relevant to evaluating the costs and benefits of vocational education is sizable and multidisciplinary. In order to make the presentation of findings more manageable, four areas of concentration were established. Each deals with theories and issues relevant to performing a national cost-benefit analysis of vocational education. These areas are:

- Literature on the economics and financing (cost) of vocational education.
- Literature on the methodology of cost-benefit analysis.

- Existing cost-benefit studies of vocational education.
- Literature on vocational education data bases.

Within the economics and financing of vocational education, two particular categories of literature are reviewed. The first is general literature on school finance. This category is important to cost-benefit analysis since an understanding of funding mechanisms is a prerequisite to measuring the costs of vocational education. The second category is literature on educational efficiency and productivity. This area is surveyed because the methodological problems in measuring education inputs and outputs in these studies are analagous to measuring the costs and benefits of vocational education.

Literature on the methodology of cost-benefit analysis includes important theoretical pieces on both cost-benefit analysis in general, and cost-benefit analysis in vocational education specifically. The presentation of literature in this area is somewhat abbreviated since the theoretical literature on cost-benefit theory is extensive, and an analysis of this literature is not the major intent of this paper. The discussion is intended to identify major sources which can provide the reader with background on the theory and technology of cost-benefit analysis.

The third area concerns the application of cost-benefit theory and methodology to vocational education. Studies that measure the costs and benefits of secondary, postsecondary, and adult vocational education are reviewed.

The final area presents literature that analyzes the availability and quality of data on vocational education. The literature in this area is limited. This dearth is of concern since the sufficiency of existing data is a primary determinant of the feasibility of conducting a national cost-benefit study of vocational education.

The literature overview, abstract, and bibliography sections of this report are each divided into the four major organizational areas. Some particular pieces of the research or literature reviewed in this project may properly fall into more than one area. The study team placed each of these pieces in the area considered to be of primary importance. In many instances, this assignment was highly subjective.

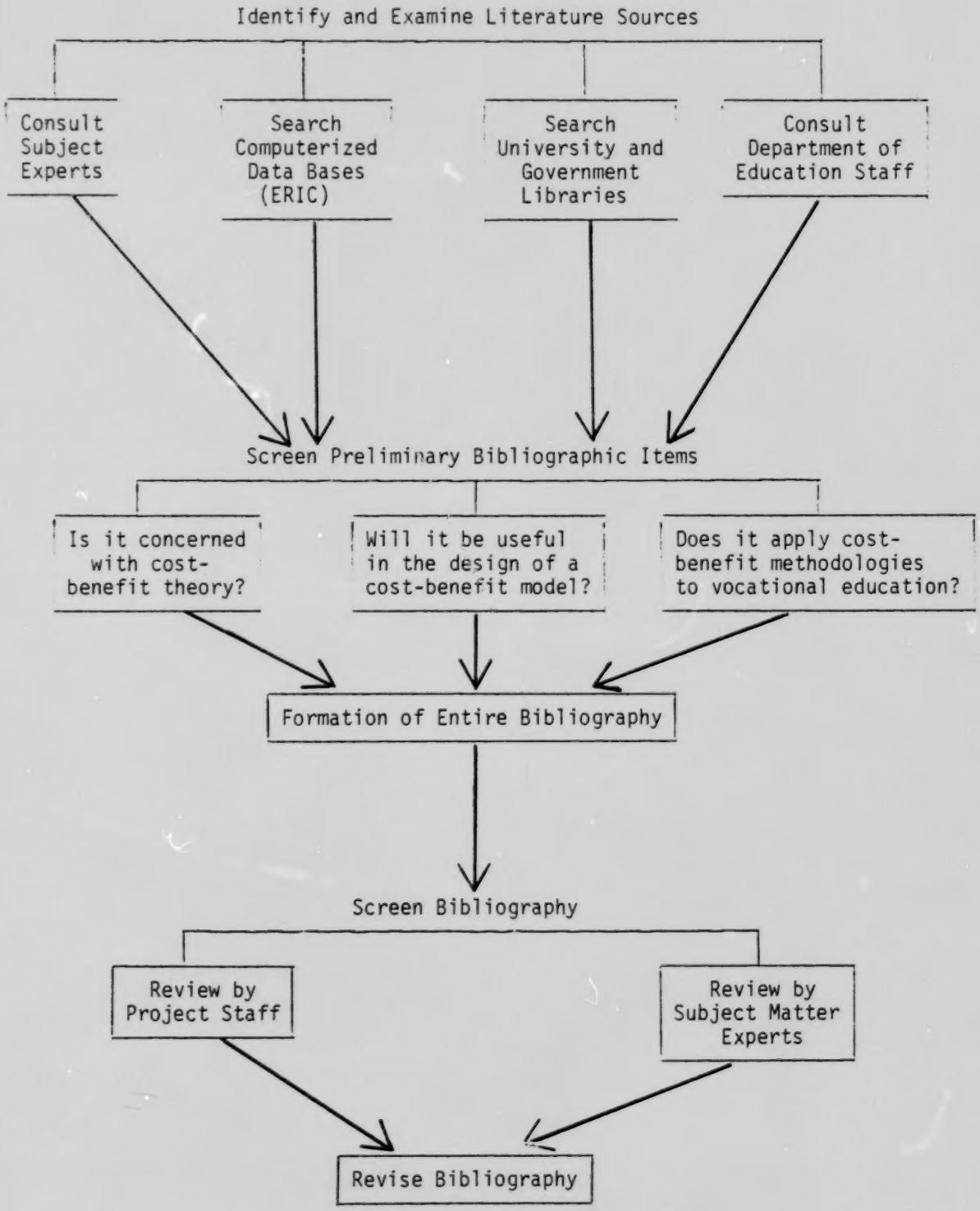
LITERATURE SEARCH METHODOLOGY

In order to insure the comprehensiveness of the literature search process, a systematic methodology was employed using sequential steps. This process is displayed in Figure 1.1. First, relevant literature sources were identified through consultation with subject matter experts and Department of Education staff, a computer search of the Education Resource Information Clearinghouse (ERIC), and manual searches of university and government libraries. Each bibliographic item was then screened by asking:

- Is it concerned with cost-benefit theory?
- Does it apply cost-benefit methodologies to vocational education?
- If it is concerned with the economics of education or vocational education data bases, will it be useful in the design of a cost-benefit model?

An item was placed in the preliminary bibliography if an affirmative answer was recorded to any of the screening questions. The preliminary bibliography was then reviewed by project staff and subject matter experts for deletion of inappropriate or dated material and notation of exemplary sources. This sequential process of identification, screening, review, and revision was ongoing during the entire course of the study.

Figure 1.1. Literature Review Methodology


Identify and Examine Literature Sources
Consult Subject Experts
Search Computerized Data Bases (ERIC)
Search University and Government Libraries
Consult Department of Education Staff
Screen Preliminary Bibliographic Items
Is it concerned with cost-benefit theory?
Will it be useful in the design of a cost-benefit model?
Does it apply cost-benefit methodologies to vocational education?
Formation of Entire Bibliography
Screen Bibliography
Review by Project Staff
Review by Subject Matter Experts
Revise Bibliography

SECTION 2
LITERATURE OVERVIEW

This section of the report presents an overview of the diverse literature related to cost-benefit analysis. Each of the citations is in some way relevant to the theories and issues in cost-benefit analysis of vocational education.

The intention of the literature overview is to summarize some of the major research within the various conceptual areas. Obviously, the amount of literature and the depth of discussion in an overview format must be restricted. Therefore, this section presents a broad brush treatment of the research.

Greater detail is available, however, in subsequent sections. The literature abstracts provide more specific information on many of the citations noted in the overview. The bibliographies paint a more complete picture of the multidisciplinary range of existing literature. The glossary defines some of the technical terms used in the overview. Considered together, these sections are designed to provide a general awareness of the depth of literature related to cost-benefit analysis of vocational education.

ECONOMICS OF EDUCATION

To fully understand the intricacies of calculating educational costs, some familiarity with school finance mechanisms is necessary. School revenues are raised from local, state, and federal sources. The federal role traditionally has been limited because funding education was not a constitutionally delegated function. However, the federal role has increased somewhat in recent years, particularly through categorical programs for disadvantaged and handicapped students.

Financing education is constitutionally reserved for the states which have instituted a variety of categorical and general aid programs. However, states have delegated much of the administration and fiscal responsibility to localities. Since localities and states are the major actors in school finance, revenue raising structures are quite idiosyncratic, which complicates the measurement of educational costs in a cost-benefit analysis.

The idiosyncracies in school funding are primarily reflected in the diverse approaches taken by states to finance public education. The history of state aid to education can be traced through the writings of Cubberly (1906), Strayer and Haig (1927), Mort (1933), Updegraff and King (1922), and Morrison (1930). Cubberly was the first person to seriously challenge the use of flat grants to fund education. He contended that a more flexible system was needed that recognized differences in district wealth and tax effort. The writings of Strayer and Haig became the basis for the most widely used of today's state assistance programs, the Minimum Foundation Plan. Under this plan, the state establishes a level of revenues per pupil that it feels is necessary for a satisfactory minimum education program. Using a fixed tax rate, the state computes each school district's ability to pay and provides to localities the difference between this level and the guaranteed minimum level. Much of the work of defining an adequate minimal education and the different needs of local districts is attributable to Mort. Updegraff and King advocated a variation of the Minimum Foundation Plan called Percentage Equalizing while Morrison supported full state assumption of educational funding, a plan which has been implemented only in Hawaii.

Interest in school finance increased dramatically after the California Supreme Court initially ruled in the 1971 case of Serrano v. Priest. The Court contended that the state's school finance structure was unconstitutional since severe revenue disparities existed between school districts. The primary reasons for these revenue disparities were a strong reliance on the local property tax for educational funding and large inequalities between localities in property tax base. The Serrano case prompted Berke and Kirst (1972) to document the extent of revenue disparities across the country and to prescribe mechanisms to finance equal educational opportunity. An outstanding overview of the problems and remedies in school finance appears in Reischauer and Hartman (1973). Other excellent texts on the funding of public schools were authored by Johns, Alexander and Jordan (1972), Berke, Campbell, and Goettel (1972), and Cohn (1974).

McLure (1976) discusses school finance issues in relation to special education programs in Illinois. This analysis includes an evaluation of the administrative and financial structures of vocational and bilingual education, as well as more traditionally defined special education programs such as those for learning disabled and handicapped students.

An additional area of research performed by educational economists that should be reviewed by those interested in cost-benefit analysis is production function studies. Since cost-benefit analysis is essentially an input (costs) - output (benefits) methodology, it shares many of the same problems as educational production function research.

A production function analysis relates quantities of inputs to one or more outputs. This technique is used primarily by educational researchers to identify what educational inputs (e.g. teacher experience, school facilities, student-teacher ratio) have the greatest influence on educational output. The most well known of this type of production function study is Equality of Educational Opportunity (Coleman, 1966).

Among the common concerns of cost-benefit and production function methodologies is controlling for non-educational variables that affect learning levels. These variables include innate ability (often measured by I.Q. scores), the richness of the home environment (measured, for example, by the number of books and magazines in the home), and family background (often measured by parents' income and educational background).

In cost-benefit analyses that compare the returns of vocational education to those of non-vocational education, a basic consideration is selecting comparison groups that are similar on these influential non-educational variables. Since matching vocational students with general education students on social background variables is difficult, researchers often utilize regression techniques to control for non-educational impacts.

In production function research, analysts are faced with the similar dilemma of partialing out confounding non-educational variables in order to examine the contribution of alternative educational inputs to educational performance. This is done primarily by regressing educational output against a variety of school and non-school variables. For example, Bowles (1970) hypothesizes an educational production function as:

$A = f(X_1 \ldots X_m, X_n \ldots X_u, X_w \ldots X_z)$, where

A = School output

$X_1 \ldots X_m$ = School inputs

$X_n \ldots X_u$ = Non-school environmental influences

$X_w \ldots X_z$ = Student's initial learning level prior to entering school

By statistically controlling the regression analysis for non-school environmental influences and a student's initial learning level, Bowles separates out the effect of school inputs on output and measures the "value added" by these inputs.

A second common concern of production function and cost-benefit analyses is measuring the end-products of the educational process. In cost-benefit analysis, one primary measurement difficulty is operationalizing non-pecuniary, as opposed to economic, benefits. In production function research, the methodological problem is identical but the terminology is different. Researchers find it difficult to measure the consequences, outcomes, or final goods of the production process (such as non-cognitive educational skills) while they are much more successful in measuring the direct outputs or intermediate goals of the production process (such as test scores and dropout rates) (Bradford, Malt, and Oates, 1969).

A third problem shared by the two methodologies is controlling for differences in program quality. It is theoretically inadequate merely to compare the quantity of output of various educational programs since the quality of the outputs may differ also. Both production function and cost-benefit researchers have attempted to adjust for quality differences by introducing proxy variables such as pupil/teacher ratio and teacher experience on the input side of the regression equation. An outstanding discussion of this process and its methodological limitations is found in Ross and Burkhead (1974).

Numerous production function analyses exist using similar regression techniques but varying in their measures of educational outputs and inputs, quality proxies, data bases, and levels of sophistication. Many of these studies (Burkhead, Fox and Holland, 1967; Katzman, 1968; Shaycoft, 1967) analyze production functions for schools in various cities. Others (Cohn,

1968; Raymond, 1968; Kiesling, 1970) use school districts rather than schools as the unit of analysis. The Shaycoft study is unique because it used longitudinal data. Shaycoft utilized Project Talent data to accumulate information on 6,583 ninth grade students. He later gave these same students a variety of achievement tests when they were in the twelfth grade. Noting the rise in achievement while controlling for socioeconomic status, Shaycoft concluded that schooling does affect pupil performance.

Among the more sophisticated input-output designs are a series of studies that create simultaneous equations to analyze production (Fox, 1969; Levin, 1970; Michelson, 1970; Averch and Kiesling, 1972; Brown, 1972). In a study of educational production in Chicago schools, Fox used two measures of school output, with each dependent variable entering the other equation as an independent variable. The logic behind this methodology is that the multiple goals of an education system are interdependent and, therefore, schools trade off between the alternative outputs. Michelson and Brown both used two-stage least squares to estimate their simultaneous equations. Levin used two-stage least squares, ordinary least squares, and reduced form estimates.

One study created a non-linear production function similar to a Cobb-Douglas equation (Hanushek, 1970). Hanushek regressed verbal scores against twelve socioeconomic and school variables using a double log specification.

There are so many commonalities between cost-benefit and production function techniques that the preceding literature can be extremely useful in the design of cost-benefit models. A review and critique of much of this work may be found in Averch, Carroll, Donaldson, Kiesling, and Pincus (1974).

COST-BENEFIT AND EDUCATION EVALUATION THEORIES

Cost-benefit analysis is a sophisticated evaluative technique. One of the most interesting presentations of the methodological components of cost-benefit analysis as well as the uses, problems, and limitations of the technique is Mishan (1976). Mishan discusses such issues as opportunity costs, shadow pricing, externalities, and discount rates. Other general discussions of cost-benefit methodology include Prest and Turvey (1965), Rothenberg (1975), Musgrave and Musgrave (1976), and Sum, Mazyed, McLaughlin and Zornitsky (1978).

Hu and Stromsdorfer (1979) analyze many of the problems in cost and benefit measurement of vocational education. Of particular interest is their contention that joint costs are not a measurement problem in cost-benefit analysis. They explain that when a school is operating at less than capacity, use of a facility by one person does not preclude use of the facility by another. Therefore, the marginal cost of using the facility is zero, and adjustment for joint costs is unnecessary.

Davie (1967) explains three criteria for making benefit-cost decisions in the context of vocational education: the present value of net benefits, the rate of return, and the benefit-cost ratio. Kaufman (1969) discusses the logic and meaning, misconceptions, and problems and limitations of the methodology in vocational education. Stromsdorfer (1967) explains, among other issues, the computation of opportunity costs, the problems in selecting a discount rate, and the danger of double-counting the benefits of vocational education since such intangible benefits as increased mobility may be already reflected by increased earnings.

Cardus, Fuhrer, and Thrall (1980) write in the area of rehabilitation research rather than vocational education. However, they suggest some means of measuring non-pecuniary benefits which should be of interest to vocational educators. Non-pecuniary benefits have traditionally been the major measurement difficulty in cost-benefit analyses of vocational education.

Hansen and Weisbrod (1969) discuss cost and benefit measurement in relation to public postsecondary education. Other studies presenting the principles of cost-benefit analysis in the context of vocational education are those of Peterson (1969) and Reinhart and Blomgren (1969)

A methodology that parallels cost-benefit analysis is cost effectiveness research. The primary difference between the techniques is that cost-effectiveness analysis expresses results in terms of physical or psychological outcomes rather than economic values. The theories and applications of cost-effectiveness are explained by English (1968), Forbes (1974), Levin (1975), and Blaschke and Sweeny (1976).

Kim (1976 and 1977a) has designed models that combine techniques of cost-benefit analysis with those of cost-effectiveness analysis. These models can generate three kinds of program measures: program effectiveness, cost-efficiency, and a cost-effectiveness and performance ratio. He has developed separate theoretical models for secondary and postsecondary vocational education.

In order to perform either cost-benefit or cost-effectiveness analysis, measurable benefits of the vocational education process must be specified. Darcy (1980) contributes to this identification process by defining 15 vocational education outcomes and discussing their use in evaluation research. These benefits are both economic and non-economic, and some can be measured far more accurately than others for research purposes. Two research efforts that help identify primary methodological issues on the cost side of cost-benefit analysis were conducted by Hale, Starnes, and Mickler (1977) and Mohrenweiser (1979).

COST-BENEFIT APPLICATIONS IN VOCATIONAL EDUCATION

Numerous researchers have applied the concepts of cost-benefit analysis to vocational education. A number of very useful reviews of this literature exist (Warmbrod, 1968; Stromsdorfer, 1972; Adams, 1972; Hu, 1980; and Mertens, McElwain, Garcia, and Whitmore, 1980). Hu's paper investigates some of the major measurement problems in cost-benefit analysis of vocational education and summarizes the literature. Mertens, et al. surveys existing cost-benefit literature in the process of analyzing whether research findings are consistent concerning the impact of vocational education on certain output variables. A separate review is performed for secondary and postsecondary vocational education. Adams presents an excellent overview of research on adult vocational education prior to 1972.

Until the early 1970's, most cost-benefit studies limited their scope to analyzing the effect of vocational education in one or more cities. Corazzini (1966), for example, examined the costs and benefits of public vocational education in Worcester, Massachusetts. Kaufman and Lewis (1968) focused on three Pennsylvania cities. Taussig (1968) compared the impact of vocational and academic high school programs in New York City. Hu, Lee, Stromsdorfer, and Kaufman (1969) contrasted the returns from secondary vocational education with comprehensive secondary programs in Philadelphia, Detroit, and Baltimore.

These studies have been followed by numerous analyses on a statewide basis. These include cost-benefit analyses in Michigan (Cohn, Hu, and Kaufman, 1972), Florida (Harris, 1972), Kansas (DeVore and Scott, 1974), Wisconsin (Webb, 1974), Missouri (McNelly and Kazanus, 1975), Illinois (Nystrom and Hennessey, 1975), Ohio (Ohio State Department of Education, 1975), New Jersey (Doty, 1976), and Massachusetts (Conroy and Diamond, 1976).

Only a handful of studies have been attempted that are more national in scope. These include Fernback and Somers (1970), Eninger (1972), and Lee (1976).

Although studies of secondary vocational education predominate in the literature, there are a variety of important postsecondary and adult analyses. Carroll and Ihnen (1966) studied the economic effects of technical education at a two-year postsecondary school in North Carolina. Included in the analysis performed by Marson, Weiner, and Sorenson (1977) are 63 adult education courses from three vocational schools. Works by Koch (1972), Osburn and Richardson (1974), and Kastner (1976) are representative of other adult and postsecondary studies.

The cost of vocational education may be measured using either average cost or marginal cost methods. Most of the research to date, whether secondary, postsecondary, or adult analyses, measures the costs of vocational education as average costs. Among the analyses employing marginal cost methods are Cohn, Hu, and Kaufman, Osburn and Goishi (1974), and Swanson (1976).

The issue of joint costs is considered in a limited number of studies. Aldrich (1972) proposes three alternative criteria for calculating joint costs: the number of student credit hours, the number of full-time equivalent faculty, and classroom square footage. Hu, Lee, Stromsdorfer, and Kaufman ignore joint cost measurement because they belive that one student utilizing a facility does not deny similar usage by other students. Therefore, the joint costs are equal to the marginal costs of facility usage which are zero.

On the benefits side, measurement difficulties have limited the majority of analyses to the consideration of economic benefits only. Economic benefits are predominately measured by the level of worker earnings. Hu, Lee,

Stromsdorfer and Kaufman, and Swanson, utilized both earnings and wage rates as measures of economic benefits.

Hamby, Harper, and Myers (1978) performed a cost-benefit analysis in Montana that did attempt to include non-pecuniary benefits. These were measured by perceptions of vocational and non-vocational students on the utility of their training, by employers' assessment of the quality of their employees' training, and by comparisons of the vocational and non-vocational students' perceptions of the quality of their life.

Hu, Lee, Stromsdorfer, and Kaufman likewise included measures of non-pecuniary benefits in their research. They utilized citizenship (measured by voting participation) and job relatedness to one's education program. Their findings show that vocational education is more job relevant than non-vocational education but that no differences exist between vocational and non-vocational graduates in voting participation.

Marson, Weiner, and Sorenson developed numerous measures of private and social non-pecuniary benefits for their study on vocational-technical adult education graduates. These included student study habits, personality traits, self-assessments of ability, attitudes toward education and employment, help from the school in job placement, permanence of job, job satisfaction, involvement in community organizations, number of promotions, and length of job search.

Galloway and Ghazalah (1972) also measured the impact of vocational education on non-pecuniary benefits. Their measures included job satisfaction, work attitude, communication skills, interpersonal relationships, and self-confidence.

The Swanson and the Kaufman and Lewis studies used job satisfaction as a measure of non-pecuniary benefits. Karnes (1966) used holding power, which is the inverse of the dropout rate, as a measure of educational benefits in his study of the impact of vocational training on slow learners who are potentially high dropout risks. Other studies employing various measures of non-pecuniary benefits were performed by Eninger, Webb, Lee, and Harris.

The findings of many studies highlight the dangers of over-aggregation in cost-benefit analyses. Results very often differ by program area, level of education, type of institution, and sex of the student. For example, Cohn, Hu, and Kaufman (1972) found that the added costs of secondary vocational education (costs above those necessary to fund non-vocational education) vary greatly by program area. The average added cost of a welding curriculum was $365. However, a home economics curriculum actually costs $15 less than a general education curriculum. In his comparision of the costs of a basic high school curriculum with a vocational curriculum, Corazzini found that there were differences between the cost of vocational education programs selected by boys and by girls. Conroy and Diamond's results show that male vocational graduates earned more and found jobs more quickly than non-vocational program graduates. No differences were observed on these variables between female vocational and general education students. Fernback and Somers' data suggest that while the net benefits of secondary vocational programs were positive, they were negative for postsecondary vocational training. Harris' research found that the rates of return of vocational education differ between secondary and postsecondary programs. He also showed that rates of return vary by program area. Swanson concluded that the efficiency of vocational training, calculated as benefit-cost ratios, varied by program area. While many training programs had positive benefit-cost ratios, the ratios for some particularly costly programs were negative.

The conclusions of cost-benefit studies of vocational education vary over time. The early studies concerning the influence of vocational education on earnings were inconclusive. Taussig, for example, found the rate of return on investment in vocational education to be quite small and the present value of benefits to be negative. However, Eninger's early study showed a rate of return twice as great as Taussig's and a positive net present benefit of $307 per student.

Later studies, however, have consistently demonstrated that the economic returns from vocational training are positive. For example, McNelly and Kazanus calculated benefit-cost ratios for secondary vocational education as high as ten to one. Koch estimated the private rate of return of postsecondary vocational training as 12.3 percent. Other studies conclude that vocational education can lead to increased earnings, greater job satisfaction, greater

levels of employment, reduced job search time, and higher overall satisfaction with one's educational program.

VOCATIONAL EDUCATION DATA SOURCES

The decentralized structure of the American education system often creates data difficulties for educational evaluators and cost-benefit study teams. Data quality and data availability vary sharply across states and even within states. There are a number of resources that review the availability and quality of vocational education data.

Brown, Barnes, Currence, and Henderson (1980) are the authors of an Office of the Assistant Secretary for Planning and Evaluation overview of vocational education research and data sources. They found a distinct difference between data bases. Of superior value, according to the analysis, are the High School and Beyond Longitudinal Survey, the National Longitudinal Study of the High School Class of 1972, the Berkeley Survey of Vocational Schools in 10 States, and the 1966 National Longitudinal Survey. Rated particularly deficient are the Bureau of Occupational and Adult Education Annual Statistical Reports and the Vocational Education Data System (VEDS). The conclusion concerning VEDS is most interesting since the data collection system was designed to overcome many existing data problems.

Lee (1979b) describes the characteristics of vocational education data at the local, state, and Federal levels. In the process, he discusses the reasons for the highly inconsistent quality of vocational education data. Lee (1979a) also discusses how vocational educators can use existing evaluative data.

Hopkins (1979) summarizes the information needs, data sources, and data deficiencies in vocational education. Of particular use is an appendix which matches various data elements with the data sources in which they are available.

Grasso and Shea (1979) review the availability of data from several national surveys. Included in their discussion are the Project Talent Data Base, Youth in Transition, the National Longitudinal Surveys, and the National Longitudinal Study of the High School Class of 1972.

Other surveys of data availability or discussions of data sources may be found in work by Vatz (1976), Pucell (1979), and Woods (1980). The latter two sources are concerned with the use of longitudinal data sets in vocational education evaluation.

A second category of useful literature discusses the existence and future potential of management information systems in vocational education. Morgan, Ballenger, and Lawrence (1974) and Starr, Black, and Gray (1977) both surveyed the availability of vocational education management information systems on a national level. Mendenhall (1977) writes about the vocational education information system in the State of Nebraska.

Various documents discuss the use of particular vocational education data sets. For example, Flanagan, Dailey, Shaycoft, Orr, and Goldberg (1962) wrote about the Project Talent data. Other pieces describe the Youth in Transition data (O'Malley, Buchanan, and Johnston, 1977); the National Longitudinal Survey (Fetters, 1975; Tabler, 1976); the National Longitudinal Study of the High School Class of 1972 (Echternacht, 1975); and the Project Baseline Data (Lee, 1974, and Peng, Stafford, and Talbert, 1976).

Ghazalah (1981) proposes that evaluators of vocational education and cost-benefit study teams utilize to a greater degree existing sources of data rather than data collected through personal surveys. One underutilized data resource is U.S. Individual Tax Returns filed with the Internal Revenue Service. Ghazalah shows how these data can be used as a source of vocational student earnings as well as providing proxy variables for employment rates and interregional mobility.

SECTION 3

ABSTRACTS

This section abstracts some of the major literature pertaining to cost-benefit analysis. The selections are representative of the diverse literature that can assist planners of a national cost-benefit study of vocational education.

The choice of citations is intended to reflect this diversity. It is not meant to provide an exhaustive listing of the primary sources related to measuring the costs and benefits of vocational education. Rather, the titles are a sampling of this primary literature.

The abstracts serve two purposes. First, they provide greater depth of information than is possible in the overview format. Second, the content summaries can direct readers to resources that match their particular information needs.

ECONOMICS OF EDUCATION

Averch, H. A., Carroll, S. J., Donaldson, T. S., Kiesling, H. J. and Pincus, J. How Effective is Schooling?: A Critical Review of Research. Englewood Cliffs, NJ: Educational Technology Publications, 1974.

This source summarizes the paramount methodological and measurement issues in relating school inputs to educational outputs. For example, the authors discuss alternative definitions of school output. They note that various student test scores are the most often used output measure. Although these tests do measure certain important aspects of the learning process, the authors contend that they have severe limitations as well. Student test scores appraise only a limited range of the many cognitive abilities learned in school. Also, they are often culturally biased and do not accurately measure the skills of minority groups.

Averch, et al. also review the various methodologies for measuring the productivity of educational resources. They discount the policy relevance of process techniques that attempt to measure the variations in the effect of the schooling process (teaching methods, curriculum, etc.) on output through laboratory observation. They write:

> Sometimes, to minimize the extent to which a student's previous learning experiences affect the outcome of an experiment, they deliberately examine learning tasks that are very unlike the learning tasks encountered in the classroom--memorizing lists of nonsense syllables, for example. Consequently, the results of the experiment offer little direct policy guidance.

The authors discuss the production function methodology rather thoroughly. Perhaps their principle contribution in this area is an extensive overview of the production function literature in education. Of particular usefulness is an appendix that individually summarizes the methodologies, variables used, and findings of much of this literature.

Benson, C. S. Education Finance in the Coming Decade. Bloomington, IN: Phi Delta Kappa, Inc., 1975.

Benson begins his book by briefly illustrating the sources of school funding, the extent of school expenditure disparities, and available measures of education outcomes. He then presents three major themes. The first is a discussion of family choice in selecting the level and quality of educational services. He discusses the principle of "voting with ones feet" and theorizes on the potential impact of educational vouchers on family choice.

The second theme is whether and how various educational resources can be more efficiently combined to increase school output. Under this heading, Benson discusses whether the level of school revenues can affect the quality of education and whether educators can determine how much money is necessary to run the public schools.

Third, Benson surveys the primary issues in school finance. He writes on the meaning of educational equity, the impact of the courts on educational funding, and the possible effect of two reform alternatives, district power equalizing and full state funding, on the distribution of school dollars.

Berke, J. S., Campbell, A. K. and Goettel, R. J. (eds.). Financing Equal Educational Opportunity. Berkeley, CA: McCutchan Publishing Corporation, 1972.

The articles in this book were developed to assist the New York State Commission on the Quality, Cost, and Financing of Elementary and Secondary Education (the "Fleischmann Commission") in developing new approaches to school finance in the state. Berke begins the book with an overview of the major issues in school finance. Other chapters address the particular sources of inequalities in New York State funding mechanisms, potential school finance programs in the state and a simulation of the impact of such reforms, the possible effect of a regional approach to school funding on revenue disparities, the potential impact of full state assumption on existing inequalities, the degree of funding inequalities in urban school districts, and a methodology to measure the match between educational revenues and the level of need in individual school districts.

Blaug, M. Economics of Education: A Selected Annotated Bibliography. New York, NY: Pergamon Press, 1978.

This is the third edition of a critical annotated bibliography of literature on the economics of education. The bibliography is largely confined to published literature (in English, French, and German) with the exception of certain mimeographed papers which can be obtained from various international agencies and institutions on request.

Blaug classifies the literature under five major chapters and according to two basic distinctions, developed and undeveloped countries. The chapters and subheadings pertaining to developed countries are:

- General Surveys
- The Economic Contribution to Education
  - Earlier Views
  - The Production Function Approach
  - Human Capital Formation
  - Measurement of Return
- The Economic Financing of Education
  - Higher Education
  - Public and Private Finance
  - Productivity and Efficiency
  - Technical and Vocational Education

The author notes that the classification scheme is somewhat arbitrary and cross-references are provided for items which could be classified under multiple headings. A chronological rather than an alphabetical listing is adopted in order to demonstrate the development of the subject over the years. There is an alphabetical index of authors for easy reference.

The author introduces each chapter with a brief summary and critique of the works listed, along with a commentary on the state of the art of literature in that particular topic area. In his overview of the body of literature on the economics of education, Blaug notes that the literature has been growing at an accelerated rate since 1950. Since new material is continuously appearing, it is the author's intention to keep the bibliography up-to-date through further editions.

Burkhead, J., Fox, T. and Holland, J. Input and Output in Large City High Schools. Syracuse, NY: Syracuse University Press, 1967.

This book reports the research findings on the education production functions for schools in Chicago, Atlanta, and the Project Talent data base. In their analysis, Burkhead, Fox, and Holland measured educational output as achievement test results, I.Q. scores, dropout rates, and intent to attend college. The independent variables included various educational and non-educational inputs. A regression analysis was run separately for each grouping of schools. The authors generally found that both school and non-school variables do affect educational output. However, the identification of significant input variables and the level of association between inputs and outputs vary between samples and output measures.

Cohn, E. Economics of State Aid to Education. Lexington, MA: D. C. Heath and Company, 1974.

Cohn's book has two principal components. The first discusses the history and technology of state aid to education. In this section, the author describes the origins of our present practices of school finance and discusses the role of early influential school finance scholars such as Cubberly, Strayer and Haig, Mort, Updegraff, and Morrison. He also writes on the varying definitions of educational equality and presents a thorough review of the alternative formulas used by states to fund education.

The second component is an empirical analysis measuring the impact of state aid on school size, per pupil expenditures, enrollment rates in nonpublic schools, per pupil bond issues, and per pupil local revenues. Cohn performs his analysis on both interstate and intrastate levels. Among his conclusions are that state aid tends to increase the total level of school expenditures but decrease the amount of local expenditures; is negatively related to nonpublic enrollments, local revenue, and bond sales; and is positively related to average school size. Cohn follows this empirical analysis by suggesting reforms that can potentially increase the efficiency of school expenditures.

Coleman, J. S., et al. Equality of Educational Opportunity. Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education, 1966.

Commonly referred to as the Coleman Report, this research is the most well known and widely cited of the input-output studies in education. Coleman and his colleagues measured the impact of a pupil's social environment and his/her educational training on student performance. They concluded that "schools bring little influence to bear upon a child's achievement that is independent of his background and general social context."

Coleman's findings on the lack of influence of the schools on output have been harshly criticized on methodological grounds. To reach these conclusions, Coleman employed multiple regression analysis entering variable clusters in a predetermined order. Socioeconomic status variables were consistently entered into the equation first, followed by school variables. Due to a high intercorrelation between many of Coleman's independent variables, the order in which the variables were entered into the regression may have biased the findings. Whatever variance in the dependent variables that was explained by the intercorrelated independent variables was attributed to the first cluster of variables, in this case the socioeconomic variables. The impact of the school variables was likely severely underestimated. Even with this bias, several school variables were found to be significantly related to pupil performance. The highest explanatory effect among school variables was the verbal ability of teachers.

Garms, W. I., Guthrie, J. W. and Pierce, L. C. School Finance: The Economics and Politics of Public Education. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1978.

This is a comprehensive overview of school finance and the economics of education on the elementary, secondary, and postsecondary levels. Among the themes discussed are how to combine educational resources to maximize efficiency, the equality of the distribution of educational benefits, the impact of various school aid formulas, and the application of economic theories and methodologies to education.

More specifically, this text discusses such issues as:

- The potential tradeoffs between the educational policy goals of equality, efficiency, and liberty.
- The role of local, state, and federal governments in education.
- The relationship between school organization and educational finance.
- The impact of collective bargaining on educational finance and governance.
- The characteristics of the taxes used to fund education.
- The goals of federal education policy.
- The status of state funding schemes.
- The impact of the Serrano case on school finance reform.
- Problems in increasing school productivity.
- School district management and budgeting procedures.
- The technology of school finance reform.
- The role of citizens in school finance reform.
- The management of capital.
- The impact of school finance on urban schools.
- The financing of higher education.

Grubb, W. N. and Michelson, S. States and Schools. Lexington, MA: D. C. Heath and Company, 1974.

Grubb and Michelson present a thorough overview of the history, definition, and technology of educational equality. In the process, they describe the status of educational equality in the states and how the structure of state aid has contributed to that status. The authors follow up this theoretical discussion with an empirical model of intrastate public school finance.

Katzman, M. T. "Distribution and Production in a Big City Elementary System." Yale Economic Essays 8 (Spring 1968): 201-256.

In this article, Katzman estimated production functions for 56 schools in Boston. Amorg his output variables were three measures of school holding power. Holding power is usually defined as the inverse of the dropout rate. Katzman measured it as the percentage of students registering at the beginning of the academic year who remain through the year, average daily attendance as a percentage of average daily membership, and the dropout rate of elementary school alumni. He also measured pupil performance by second and sixth grade reading scores and the percentage of students passing the entrance exam for the prestigious Latin School.

Katzman entered the following input variables in his production function: class size, percentage of students in crowded classrooms, student/staff ratio, number of students in the school district, percentage of teachers with permanent status, percentage of teachers with masters degrees, percentage of teachers with one to ten years experience, percentage of annual teacher turnover, and an index of cultural advantage. The creation of a cultural advantage index is one way to overcome multicollinearity among various socioeconomic variables.

Katzman found that the index of cultural advantage, size of the school district, teacher experience, and student/staff ratio all affect educational output in at least one equation. However, none of the variables were significant in all output equations.

McLure, W. P. Special Programs in Public Schools: Administrative and Financial Structures. Urbana-Champaign, IL: University of Illinois at Urbana-Champaign, Bureau of Educational Research, 1976.

McLure and his staff examine the administrative and financial structures of special education programs in Illinois. Included in the analysis are vocational education and bilingual education programs as well as more traditionally defined special education services such as those for learning disabled or handicapped children. This discussion of the finance and governance of special education programs in Illinois provides good background on the issues and problems faced in many states. McLure concludes with a presentation of recommendations to improve further the finance and governance systems in Illinois.

Pincus, J. (ed.). School Finance in Transition. Cambridge, MA: Ballinger Publishing Company, 1974.

Pincus has compiled and edited a series of articles by school finance scholars on a diversity of funding issues. The book contains chapters on:

- Alternatives to existing funding mechanisms.
- The impact of the courts on school finance.
- The influence of school finance reform on tax policy.
- Effects of school resources on educational outcomes.
- The politics of school finance.
- The influence of school finance problems on broader social issues.

Reischauer, R. D. and Hartman, R. W. Reforming School Finance. Washington, DC: The Brookings Institution, 1973.

Reischauer and Hartman's book is a classic textbook treatment of the primary issues in school finance. The authors first describe the causes of the fiscal dilemma in funding education. They attribute the crisis partially to the rapid rate of expenditure increase since 1960 that was prompted by increased enrollment and rising prices. A second determinant was the inability to squeeze increased dollars out of traditional revenue raising structures. School funding relies heavily on the local property tax. Many citizens felt this tax was regressive and already too high, and therefore, refused to vote for increased spending in school budget referendums.

The authors also present data on the extent of revenue and expenditure disparities between states and school districts. They discuss mechanisms to reduce these disparities such as larger state equalization programs, full state financing, capacity equalization, and federal intervention. They also explain, in a separate chapter, the fiscal and enrollment problems that face non-public schools.

Ross, J. P. and Burkhead, J. Productivity in the Local Government Sector. Lexington, MA: D. C. Heath and Company, 1974.

In this book, Ross and Burkhead explain the definition and measurement of public sector productivity. They discuss the difficulties in relating quantities of inputs to the level and quantity of output of public services. They also explain the impact of alternative definitions of productivity on measures of the efficiency of production, survey various methodological approaches to the measurement of productivity, and review examples in the literature that attempt to measure productivity. Although the presentation does not focus on educational production per se, it is highly relevant to this area, and does apply many of the theoretical issues to the measurement of educational productivity.

The authors also develop a methodology for analyzing changes in government expenditures. This methodology is applied to four service areas: education, welfare, police, and fire. The data utilized are from New York State.

Sacks, S. City Schools/Suburban Schools: A History of Fiscal Conflict. Syracuse, NY: Syracuse University Press, 1972.

Sacks presents many of the important issues in school finance while building a model to determine the determinants of per pupil current educational expenditures. The determinant (independent) variables in the model are per capita income, the proportion of the population attending public schools (enrollment ratio), and the level of state elementary and secondary school aid. Sacks performs his analysis for urban school districts and suburban districts to assess the degree of the bias against cities in school finance. Among Sacks' findings are:

- Differences in average income between urban and suburban communities are a determinant of disparities in per pupil expenditures.
- The level of state aid affects the overall level of expenditures within a state.
- The relationship between the proportion of a district's children attending public schools and per pupil expenditures is negative.
- State aid is additive and not substitutive, but does tend to reduce local effort.

COST-BENEFIT AND EDUCATION

EVALUATION THEORIES

Cardus, D., Fuhrer, M. J., Thrall, R. M., et al. A Benefit-Cost Approach to the Prioritization of Rehabilitative Research. Houston, TX: Baylor College of Medicine, The Institute for Rehabilitation and Research, 1980.

This work represents the findings of a research effort begun in 1971 with the purpose of constructing "a mathematical evaluation model that would take into account both the monetary and non-monetary benefits of rehabilitative research." As a result, Cardus, Fuhrer, and Thrall have developed a model with aspects which are directly relevant to a cost-benefit analysis of vocational education.

Cardus, Fuhrer, and Thrall propose a multidimensional model, measuring groupings of costs and benefits along unique dimensions. For example, the monetary benefits resulting from vocational education would be measured along one dimension while nonpecuniary benefits could be measured on a different scale along a unique dimension. These different measures would be summed as a function of a group of parameters determined by the policy maker.

The report has chapters on operationalizing the terms of the proposed cost-benefit model and implementation of the model. A chapter is also provided detailing a systematic process to weigh the various benefit dimensions. The report ends with two appendices. One details the process used to cluster benefits while the other appendix provides an excellent discussion on the appropriate methodological approaches to relate costs and benefits.

Darcy, R. L. Some Key Outcomes of Vocational Education: A Report on Evaluation Criteria, Standards, and Procedures. Columbus, OH: Ohio State University, The National Center for Research in Vocational Education, 1980.

This study discusses the use of outcomes as a measurement tool in evaluating vocational programs. The focus is upon fifteen outcomes and their feasibility as evaluation criteria. These outcomes were rated by a small sample of people familiar with program evaluation and vocational education as to their importance and feasibility. These ratings are included in the study.

The final section reports the findings of a pilot test of one program evaluation outcome (reducing the risk of unemployment for minority youth) based on data from two states with large minority populations. While the author describes available data sources for outcome evaluation, the pilot test documented the problems associated with identifying data on minority youth with vocational training. The research indicates that data limitations may confront vocational evaluators regardless of the outcome measure utilized.

Davie, B. F. "Benefit/Cost Analysis of Vocational Education: A Survey." Occupational Education--Planning and Programming. Volume Two. A. Kotz, ed. Menlo Park, CA: Stanford Research Institute, 1967.

General considerations in benefit-cost analysis of vocational education are presented in this work. Included are detailed lists of the potential costs and benefits of vocational education and a discussion of three criteria for making benefit-cost decisions: (1) present value of net benefits, (2) rate of return, and (3) benefit-cost ratio. Davie suggests that the benefit-cost ratio is superior to the other measures. He also discusses the merits of cost-effectiveness analysis and explains one potential use of this methodology.

Davie makes the following general conclusions about cost-benefit analysis. He believes it is not sufficient in cost-benefit analyses to address the question, "Should a program be continued or discontinued?" Rather, one must ask, "Should the resources devoted to this program be diverted instead to a specific alternative (in order to produce a more useful result)?" Second, he contends that if the societal benefits associated with a particular vocational education program are significant but the monetary rewards to individual participants are slight, stipends should be offered to encourage enrollment in vocational programs.

Davie also reviews three early cost-benefit analyses. These are Eninger (1967), Corazzini (1966), and Carroll and Ihnen (1966).

Dorfman, R. (ed.). Measuring Benefits of Government Investments. Washington, DC: The Brookings Institution, 1965.

This collection provides evaluative papers on seven types of government projects. The authors of these papers are Gary Fromm, Herbert E. Klarman, Ruth P. Mack and Sumner Myers, Herbert Mohring, Jerome Rothenberg, Frederic M. Scherer, and Burton A. Weisbrod. Dorfman prefaces these articles with a brief discussion of cost-benefit methodology.

Of particular relevance is the article "Preventing High School Dropouts" by Weisbrod. Weisbrod utilizes cost-benefit analysis to evaluate a dropout prevention program. Aggregated data concerning income differentials between non-college bound high school graduates and high school dropouts are applied to a specific case study conducted in St. Louis, Illinois. Non-pecuniary components are incorporated into the analysis as biases, although no absolute monetary value is assigned. Weisbrod concludes that in at least this case study, monetary costs far exceed benefits. This selection also includes an excellent discussion on discount rate measures, an insightful rebuttal by Herman P. Miller, and Weisbrod's reply.

Hale, J. A., Starnes, P. M. and Mickler, W. A. The Development and Testing of a Model for Determining the Costs of Vocational Education Programs and Courses (Final Report). Gainesville, FL: University of Florida, Institute for Educational Finance, 1977.

This study was designed to develop and field test an "added cost" model for calculating vocational program costs per full-time equivalent student. Hale emphasized the difficulty in cost determination because of discrepancies in data format. He noted, however, that the overall quality of pupil and fiscal accounting data is improving.

Program data, student accounting data, and fiscal accounting data were compiled to determine the added-cost relationship of vocational education programs. Among the conclusions were that:

- Vocational courses should pay closer attention to Department of Labor Occupation codes and the Office of Education vocational course numbering scheme.
- A "basic" program needs to be commonly defined.
- Discrepancies in student accounting methods used by secondary and postsecondary institutions do not allow for interorganizational comparisons.
- Student contact hours is the best student accounting method.
- Better data bases for fiscal accounting seem to exist at the postsecondary level.
- Objects-of-expenditures provide the common basic structure for relating expenditures to courses and program areas.

The study also includes a User Manual containing the data forms, user instructions, a course cost algorithm, sample data classifications, definitions and their sources, and a suggested data processing coding structure.

Hu, T. and Stromsdorfer, E. W. "Cost-Benefit Analysis of Vocational Education." Handbook of Vocational Education Evaluation. C. K. Tittle and L. Cohen, eds. Beverly Hills, CA: Sage Publications, Inc., 1979.

Hu and Stromsdorfer present a concise overview of the methodological and measurement difficulties in performing a cost-benefit analysis of vocational education in this work. The presentation is divided into separate discussions of the problems of measurement on the cost side and the benefit side.

On the cost side these problems include the distinction between educational expenditure and educational cost, joint costs, current costs, and capital costs. The problems in benefit measurement that are treated include wages versus earnings, noneconomic benefits, and transfer payments.

The authors also discuss a number of empirical studies estimating the costs and benefits of vocational education. They conclude that these studies have suffered from the inadequate availability of data and the inability to successfully measure non-economic benefits and costs of vocational education.

Kaufman, J. J. Cost-Effectiveness Analysis as a Method for the Evaluation of Vocational and Technical Education. Washington, DC: Department of Health, Education, and Welfare, Office of Education, 1968.

This paper discusses cost-benefit analysis in terms of: (1) logic and meaning, (2) some of the misconceptions which prevail concerning this method of evaluation, (3) some of the problems and limitations of this method, and (4) the conclusions of one study which attempted to determine whether or not there is a pay-off from an investment in vocational and technical education.

In the discussion of the logic and meaning of cost-benefit analysis, the methodology is described as an attempt to establish the equivalent of a system of market principles for various types of government activities. Kaufman makes the important point that one should not talk about education in terms of cost or needs alone. No cost can be justified without a reference to pay-off; and the satisfaction of any need cannot be justified without reference to cost. He continues that since decisions must be made as to the allocation of resources among competing educational programs, cost-benefit analysis is an appropriate method for making these choices. It tends to force administrators to think through their objectives, to concentrate on costs, and to think in terms of alternatives.

A number of what Kaufman describes as misconceptions about cost-benefit analysis are presented. These include statements such as (1) cost-benefit analysis is merely a subterfuge for seeking to conduct education on a "least-cost" basis; (2) since benefits are measured only in dollar terms, this is a form of crass materialism; (3) because cost-benefit analysis measures pecuniary benefits, program objectives with nonquantifiable results cannot be justified by cost-benefit study; (4) cost-benefit technique has not been fully developed and therefore should not be applied; and (5) cost-benefit analysis appears to ignore political considerations.

Kaufman also discusses the meaning of and problems in educational evaluation. He writes that measurement is a necessary part of evaluation, but evaluation requires both premeasurement and postmeasurement considerations. Before measurement commences, evaluation requires the formulation of a basic educational philosophy (and its attendant goals) and the statement of specific behavioral objectives to be measured. After measurement is completed, evaluation requires: (1) the analysis of measured quantities in terms of the attainment of objectives and progress toward goals; (2) an estimate of the value of existing programs in determining this progress; and (3) an estimate of the costs involved in conducting these programs.

The two paths to greater acceptance of evaluation are: (1) to assure the school administrator that the evaluation is to be used to study the process of education within the school and to help him/her improve this process, and not for the purpose of making value judgments about the school; and (2) to follow up this assurnace by utilizing evaluation procedures which are aimed at collecting only those data relevant to the educational process.

Kaufman includes a discussion of the findings of his Pennsylvania study as an example of cost-benefit research, In the study he found that vocational-technical graduates earned significantly more and were employed significantly longer than the graduates of the other curricula during a six-year post-graduate period. It was assumed that earnings and employment are appropriate indices of the benefits of education.

Kim, J. E. A Cost-Effectiveness/Benefit Analysis Model of Postsecondary Vocational Programs (Technical Report). Bloomington, IN: Indiana University, Department of Vocational Education, 1977.

This technical report presents a cost-effectiveness/benefit analysis model for post-secondary vocational programs which was developed for the Indiana State Board of Vocational and Technical Education. Kim defined cost-effectiveness/benefit analysis as a technique for assessing the outputs of existing and/or new programs in relation to their specified program target goals and against the associated costs. The specific project objectives were: (1) to conceptualize cost-effectiveness/benefit analysis; (2) to develop a conceptual model, data forms, and a standard procedure for using this model; (3) to evaluate the model and data forms; and (4) to produce an administrator's manual.

A tri-dimensional structure was conceptualized for vocational program evaluation. The structure consisted of: (1) program classification by degree level; (2) the criteria of effectiveness, efficiency and performance; and (3) a time frame for one-year completion, two-year graduation, and follow-up survey.

A cost-effectiveness/benefit model was developed within the input-output framework. Social demand, support, and student characteristics were considered as inputs to the school system, and monetary and non-monetary benefits for society were viewed as long-term outcomes of the educational system. Four major components of the model were specified by: (1) program classification; (2) program objectives; (3) program outputs; and (4) program costs.

The model was designed to generate three kinds of cost-effectiveness/benefit measures: (1) program effectiveness; (2) cost-efficiency; and (3) a cost-effectiveness and performance ratio. Fifteen formulas were presented to compute these measures. Target goal statements were developed to include five objectives: (1) enrollment; (2) career preparation; (3) placement and employment; (4) advanced studies; and (5) economic benefits. The two data forms developed in accordance with the program objectives were: (1) a data form designed to determine program goals and outputs pertaining to enrollment, career preparation, job placement, advanced studies, and long-term benefits; and (2) a simplified data form for analyzing and computing direct and indirect program costs.

Kim, J. E. and Harris, R. C. A Cost-Effectiveness Analysis Model for Secondary Vocational Programs (Technical Report). Bloomington, IN: Indiana University, Department of Vocational Education, 1976.

This paper presents a conceptual model to analyze the cost-effectiveness of secondary vocational programs focusing upon program effectiveness, cost efficiency, and management performance. The model consists of four components: vocational program classification; program objectives; program outputs; and program costs. It generates three kinds of cost-effectiveness measures: program effectiveness, cost efficiency, and cost-effectiveness and/or performance ratio. The authors identify eight elements for analysis and base the model upon these elements. They also distinguish cost-benefit analysis from the cost-effectiveness concept.

Levin, H. M. "Cost-Effectiveness Analysis in Evaluation Research." Handbook of Evaluation Research. M. Guttentag and E. L. Struening, eds. Beverly Hills, CA: Sage Publications, 1975.

This paper discusses cost-effectiveness analysis in evaluation research and focuses upon its application to social programs and policies. The author presents a rationale for utilizing cost-effectiveness methodologies and compares them to cost-benefit and cost-utility analyses. He then discusses the cost-effectiveness technique in detail examining both its conceptual nature and the methodology of assessing the costs of alternatives and of measuring effectiveness. Levin cites a number of studies that used either cost-benefit or cost-effectiveness techniques.

He concludes that the cost-effectiveness technique is a potent source of information. However, its results need to be combined with other factors in order to make rational policy decisions.

Mohrenweiser, G., et al. Planning Design for Conducting a National Survey of the Differential Cost of Vocational Education. Minneapolis, MN: Educational Management Services, Inc., 1979.

The objectives for this project were (1) to design a national survey utilizing the Institute of Educational Finance differential cost model of costing secondary and postsecondary vocational educational programs, and (2) to modify the model to allow for separation of the costs associated with educating the handicapped from basic education costs. The project determined in a field test that the model adequately calculated differential costs of vocational education at the subprogram level.

National Institute of Education. The Vocational Education Study: The Interim Report. Washington, DC: U.S. Government Printing Office, 1980.

This report discusses the effects of the changes in Federal vocational education legislation adopted in 1976 upon the distribution of Federal funds and the planning and evaluation of vocational education programs by the states. It also describes the results of research on the effects of participating in vocational education programs and surveys selected features of public school vocational education. In addition, the report examines the various effects of vocational education upon program participants. All of these issues are themes in this ongoing research effort that was mandated by the Education Amendments of 1976 (P.L. 94-482).

Prest, A. R. and Turvey, R. "Cost-Benefit Analysis: A Survey." The Economic Journal 75 (December 1965): 683-735.

Prest and Turvey define cost-benefit analysis as a technique for determining which public investment projects will have the greatest net benefits for society as a whole. This article provides a discussion of the general principles of the methodology followed by examples of how cost-benefit analysis could be applied to the evaluation of several types of public investment projects. The application of cost-benefit analysis to evaluate public education is one of the examples used.

Prest and Turvey equate the benefits of a particular project to what people would be willing to pay for them if an effective market for the goods or services existed. Costs are equal to the present value of consumption foregone in order to finance the project. Translating this theory into practice, however, is problematic. For example, calculating the present value of consumption foregone in order to finance the project is sometimes complicated by the fact that what is foregone may not be just present consumption. If the project in question would take funds away from other investment projects which would have provided other goods and services in the future, then the present value of those goods and services represents a part of the cost of undertaking the public investment project.

Prest and Turvey correctly assert that cost-benefit analysis may be of limited use for evaluating projects that are national in impact since these projects are likely to alter the universe of prices. Costs and benefits are calculated assuming that prices remain constant. If the project being studied causes prices to change, conclusions about its net benefits could be misleading.

Problems in measuring the benefits of investment in education are also discussed in this review. Increased income is a positive benefit to society to the extent that it represents an increase in productivity. However, Prest and Turvey question the actual correlation of earnings and marginal productivity (or marginal value to society). Also, they note the problem of using cross-sectional data to predict income into the future. However, Prest and Turvey suggest that even though cost-benefit analysis of public projects involves making subjective estimates of the dollar value of the project's benefits, especially for non-pecuniary benefits, such an analysis is superior to solely relying on vague qualitative judgments of a project's worth.

Reinhart, B. and Blomgren, H. Cost Benefit Analysis--Trade and Technical Education (Final Report). Los Angeles, CA: University of California, Division of Vocational Education, 1969.

This report contains introductory material on cost-benefit analysis, a review of two cost-benefit studies of vocational education, and a discussion of two basic approaches to cost-benefit analysis of vocational education. A proposal for a cost-benefit study of high school and junior college vocational education follows the general text. Among the theoretical components of cost-benefit analysis discussed are joint costs (when a vocational program shares facilities with an academic program, the authors conclude that it is not necessary to sort out how much of the value of that facility should count as a vocational education cost), and capital costs (the authors include a formula which explains how to count the cost of capital equipment which will outlast the program being studied).

Reinhart and Blomgren write that there are two broad categories of cost-benefit studies in vocational education: (1) vocational versus academic education, and (2) vocational versus vocational education. Most analyses of vocational education have so far been of the first type. In this approach it is assumed that vocational and academic education are different means of achieving the same ends. This erroneous assumption may cause misleading results. It is proposed that studies of the second type be conducted instead in which the levels of cost-effectiveness of various vocational education programs may be compared.

Rothenberg, J. "Cost-Benefit Analysis: A Methodological Exposition." Handbook of Evaluation Research. M. Guttentag and E. L. Struening, eds. Beverly Hills, CA: Sage Publications, 1975.

This paper examines the methodological considerations in cost-benefit analysis. The author also presents applications of cost-benefit designs to suggest the scope of issues encountered.

Included in the discussion are such issues as the structure of social evaluation; the structure and scope of cost-benefit analysis in terms of ends, means, and scarcity; individual, group, and social evaluation; the value context of cost-benefit analysis; the meanings and benefits of costs, income level, and income distribution; issues in measuring benefits and costs; and examples of applications.

Rothenberg concludes that cost-benefit analysis is an attractive method for certain situations. However, he also raises concerns about its practical usefulness when there is a serious inadequacy of relevant data.

Smith, R. E., "The Opportunity Cost of Participating in a Training Program." Journal of Human Resources 6 (Fall 1971): 510-519.

This paper presents an analytical model to estimate the foregone income of students in a manpower training program. The model is applied to institutional training under the Manpower Development and Training Act (MDTA).

The author believes that estimating foregone earnings of trainees is the weakest component of most economic analyses of manpower programs, yet none of the methodological studies reported in the literature have focused specifically on this problem. The assumption implicit in most studies is that current employment status is an unbiased estimate of subsequent status. Smith contends that this is valid only if entrance into the program is unrelated to economic status, an assumption that is not likely to be true.

To estimate the proportion of the trainee group that would have been employed in each of the months of training (or the probability that any particular trainee would have been employed), the author assumes the condition of a first-order Markov chain process.

To estimate the trainees' foregone earnings, Smith calculates their likelihood of being employeed, given their demographic characteristics, education, labor market handicaps, and the overall level of unemployment in the region. Using a Markov process, each trainees' likelihood of employment is in this way estimated for each month of the training program. These employment rates are combined with a rough estimate of the average rate of the appropriate comparison groups to compute an estimate of total foregone earnings.

In an application of the model on a select group of MDTA institutional trainees, the average foregone earnings was estimated at $1,280, considerably greater than generally assumed. Smith discusses two policy issues that were raised by his findings. First, to the extent that the earnings loss is not offset by gains of non-trainees, the immediate loss to the economy is greater than asserted in most evaluations, suggesting a lower benefit-cost or effectiveness-cost ratio for the training programs. Second, the redistributional impact of manpower programs may not conform with the intent of the legislation.

Beginning in fiscal 1967, one explicit objective of MDTA training has been to aid the competitively disadvantaged in the labor market. The estimates of the foregone earnings of trainees made by the study suggest that, in the short run, the trainees themselves are bearing a large portion of the training costs, even after receipt of training stipends. If the trainees are persons to whom society wishes to transfer purchasing power in the current period and increase the expected value of their future earnings, the training stipends or other transfers would need to at least balance their immediate earnings losses.

Stromsdorfer, E. W. "Economic Concepts and Criteria for Investment in Vocational Education." Occupational Education--Planning and Programming. Volume Two. A. Kotz, ed. Menlo Park, CA: Stanford Research Institute, 1967.

Stromsdorfer reviews various techniques in, and components of, cost-benefit analysis of vocational education. He includes a particularly interesting discussion of the potential problem of double-counting educational benefits. By way of example, Stromsdorfer explains that the counting of certain intangible benefits of vocational education, such as increased mobility or labor force discipline, may be redundant if they are already reflected in increased earnings. Similarly, to consider the extra income tax revenue generated by vocational graduates would be double-counting since this revenue comes from their gross earnings which already is probably included in the cost-benefit model. Reduction in welfare benefits is not calculated as a net benefit to society since it merely transfers funds from one group to another.

Stromsdorfer also makes the following conclusions:

- It is possible that rather than reducing aggregate unemployment, vocational education actually displaces untrained workers with those who have received vocational training. This displacement would have to be figured into the costs of vocational education.

- Spending public money on vocational education may constitute an indirect subsidy to industry. Since it expands the supply of skilled labor, vocational education allows firms to pay wages that are lower than they would otherwise have to pay, thereby increasing profits and/or reducing output prices.

He also discusses the trade-offs between the present value of net benefits and internal rate of return criteria and circumstances under which any cost-benefit criteria may be inappropriate.

COST-BENEFIT APPLICATIONS IN VOCATIONAL EDUCATION

3-4157

Carroll, A. B. and Ihnen, L. A. Costs and Returns of Technical Education: A Pilot Study. Raleigh, NC: North Carolina State University, 1966.

In this paper, Carroll and Ihnen present a relatively comprehensive analysis of the costs and benefits resulting from two years of postsecondary schooling. The study is based on information concerning 45 graduates of Gaston Technical Institute, North Carolina, and their high school peers of similar academic performance who did not continue formal education after high school.

Incomes of individuals may be affected by many factors other than formal schooling. Carroll and Ihnen employed regression analysis to determine the portion of observed earnings differential that was attributable to technical training. Individual earnings per month was regressed on a dummy variable for technical schooling, high school grade average, age-experience, mother's education, residence during high school, military experience, migration from home community, size of high school class, and two trend variables. All the coefficients were significant. Technical schooling was estimated to increase earnings by $38.98 per month.

Cost estimates consisted of: (1) costs for books and student supplies; (2) school facilities, supplies, and personnel; and (3) loss of production by students while enrolled in school. In probably the weakest methodological step of the paper, estimates of future earnings differentials were based on differences exhibited in cross-sectional data of individuals who had completed only high school and those with one to three years of college experience. The report also attempted to estimate a partial evaluation of the additional fringe benefits typically enjoyed by individuals with technical educations.

In this report, Carroll and Ihnen reconcile the costs and benefits of technical schooling by both the rate of return and discounted present value methods. Private and social rates of return are evaluated. The report also includes a discussion of appropriate discount rates. Carroll and Ihnen concluded by asserting that high rates of return exist for investment in post-secondary technical schooling.

Conroy, W. G. Jr. and Diamond, D. E. The Impact of Secondary School Occupational Education in Massachusetts. Lowell, MA: The University of Lowell, 1976.

This is a study of the impact of vocational education on workers' earnings in Massachusetts. A random sample of 2,600 vocational-technical and general academic program graduates was the subject of study. The authors found that male vocational school graduates had an average annual salary that was $1,378 higher and found jobs an average of four months sooner than male general academic program graduates. Female vocational program graduates did not generally earn more than female general academic graduates.

The authors also make various conclusions about the characteristics of Massachusetts' vocational population. Vocational school students were of lower socioeconomic status, scored lower on scholastic aptitude measures, evaluated high school as a more positive experience, and received more help from their schools in finding jobs than did academic students.

Corazzini, A. J. Vocational Education: A Study of Benefits and Costs. Princeton, NJ: Princeton University, 1966.

Corazzini's study is one of the earliest cost-benefit analyses in vocational education. Its findings question the efficiency of investment in vocational education. This report summarizes a study of the costs and benefits of public vocational education in Worcester, Massachusetts. Differences between regular and vocational education were calculated with respect to their public direct costs (current account items such as teacher salaries), public implicit costs (such as what the city would earn if it rented out the school building and equipment), and direct private costs (costs incurred by students for books and supplies). Measurement of the cost differential between regular and vocational education was simplified since Worcester has separate institutions for these two types of education.

In a series of sub-studies, Corazzini also examined the impact of vocational education on student benefits measured as an increase in lifetime earnings, increase in intergenerational mobility, and increase in geographic mobility. In one sub-study, the starting wages of high school graduates in selected local firms were compared. The differential between the wages of graduates from regular high school programs and those of graduates from vocational high school programs was determined. Corazzini then calculated the number of years this wage differential must be maintained in order for vocational education to justify its extra costs. He found that after a few years of experience, workers' wages do not generally depend on whether they attended regular or vocational high schools. Assuming that the vocational high school graduates at these firms would have gone to a regular high school had the vocational program been unavailable, Corazzini concludes that by this measure the costs exceed the benefits.

Another sub-study examines the benefits of vocational education under the assumption that its availability prevents some students from dropping out of school. By this measure, the benefit of vocational education is the difference between the lifetime expected income of a vocational high school graduate and that of a dropout. Corazzini concludes that if every vocational high school graduate would have dropped out had vocational education been unavailable, then the benefits of these vocational programs exceeded their costs. However, the impact of vocational education on dropout rates is not known.

Another sub-study followed the employment history of graduates from a girls vocational high school for 18 months after graduation. Research showed that their wages were very close to the Federal minimum wage. No attempt was made to determine whether graduates from this program were more successful in finding jobs than women who had graduated from the regular high school.

The benefit of intergenerational mobility was studied by comparing the type of job of vocational program graduates to those of their fathers. Over fifty-three percent of the vocational program graduates were white collar workers, but only 17.4 percent of the fathers were in this category. Corazzini concluded from this limited data that vocational education is probably responsible for enhancing intergenerational mobility. He also suggested that on the basis of where vocational program graduates accepted jobs, there was no evidence that vocational education had enhanced their levels of geographic mobility.

Doty, C. R., et al. Model for Calculating Cost per Pupil for Secondary Vocational, General, and Transfer Curricula in Comprehensive High Schools, Shared Time Vocational Schools (Final Report). New Brunswick, NJ: Rutgers University, Department of Vocational-Technical Education, 1976.

This study reports the findings of a two-stage investigation into the cost of education programs. The objectives of the first stage of the study were to review the literature, to identify and define financial cost variables, to develop, test, and revise a data collection model, and to report the findings.

The second stage involved refining the model; developing guidelines for local administrators to use the model; applying the model in a comprehensive high school, a full-time vocational school, and a shared time vocational school; and identifying the cost ratio among vocational, college preparatory, and general education programs.

A stratified random sample was utilized and data collected from four public schools in New Jersey. The authors conclude that the model developed can provide accurate costs per pupil per program or educational goal, although there are some limitations on its applicability to all types of schools.

Eninger, M. U. Effectiveness Evaluation Data for Major City Secondary Education Systems in the U.S. Pittsburgh, PA: Educational Systems Research Institute, 1972.

This article discusses the Manpower Conversion Equation which is a theoretical model designed to enable vocational education administrators to manage manpower development systems and to apply management tools to vocational education programs. The model states that supply should equal demand for skilled manpower. From this model, six vocational education objectives were generated by Eninger. Questionnaires were given to a sample of graduates from 449 secondary schools in 22 cities and analyzed by sex and race, type of program, and type of occupation. Ten problem areas were identified in the analysis: absence of the manpower conversion concept, absence of measurable vocational education objectives, inadequate vocational education supporting systems, undefined responsibility and accountability, inappropriate administrative organization for effective vocational education, inadequate relations with the employer community, inadequate relations with the community of parents, absence of vocational education operational research, inadequate involvement of vocational teacher personnel, and inadequate application of management concepts, principles, and techniques.

Galloway, L. E. and Ghazalah, I. A. The Role of Vocational Education in Improving Skills and Earning Capacity in the State of Ohio: A Cost-Benefit Study. Athens, OH: Ohio University, College of Business Administration, 1972.

The authors report the methods and findings of a benefit-cost analysis of 14 subject areas of vocational education in 18 high schools. Both private and social rates of return were calculated for each subject at each high school. The study employed two different comparison groups, high school dropouts and students enrolled in non-vocational programs.

The study utilized both monetary and non-monetary benefits. Monetary benefits were calculated as earnings. The non-monetary measures included job satisfaction, work attitude, communication skills, interpersonal relationships, and self-confidence. For most programs, the authors found favorable rates of return and recommended continued investment in secondary vocational education.

Hamby, J., Harper, R. and Myers, L. A Comparison Study of the Benefits of Secondary and Postsecondary Vocational Education. Portland, OR: Northwest Regional Education Laboratory, 1978.

This study examined the returns on investment of secondary and postsecondary vocational training curricula in Montana. The research is notable for its use of non-pecuniary educational benefits.

The population studied was 857 high school graduates of the classes of 1970 and 1971 who were between 23 and 25 years old at the time of the survey and who had been employed for at least two years since their graduation. Data were collected through telephone interviews, employer surveys, and mailout surveys. The focuses of the data collection were on the graduates' perceptions of their training, employers' perception of the training, and comparison of graduates' perceptions of quality of life. The population was divided into three groups based upon their training: (1) postsecondary vocational, (2) secondary vocational, and (3) academic/general.

Among the results, the authors found that postsecondary vocational graduates were more satisfied with their training and had attitudes employers seek in their employees, but had a tendency toward feelings of depression. Not surprisingly, academic/general graduates had high esteem for academic educational programs, while postsecondary and secondary vocational students had low esteem for these programs.

Harris, M. A. Benefit-Cost Comparison of Vocational Education Programs: Statewide Evaluation of Vocational-Technical Education in Florida. Tallahassee, FL: Florida State University, 1972.

This study was concerned with statewide benefits and costs of vocational education programs in Florida. The purposes of this study were fourfold:

- Develop a methodology for conducting a statewide benefit-cost study of vocational education programs in Florida.
- Examine, compare, and analyze the public and private benefit and cost aspects of four vocational education programs in Florida.
- Compare the public and private benefit and cost aspects of students who attend vocational education programs while enrolled in day high school and students not enrolled in day high school.
- Produce formulas which result in the development of a model for predicting public and private economic returns of vocational education programs.

The study included measures of both public and private vocational education costs and pecuniary and non-pecuniary benefits. Among the measures of non-pecuniary benefits were whether former vocational education students were employed and the degree to which students were employed in occupations related to their vocational education programs.

To account for the influence of regional price variations and regional labor market conditions and wage rates, the analysis divided the state into major geographic regions. Within each region, two institutions designated as area vocational centers were randomly selected. Based upon stated criteria, four vocational education programs were included in the study.

The differences between the net wage rates for skilled workers and the net wage rates for unskilled workers represented the net economic benefits resulting from vocational education programs. The annual benefits before Federal income tax deductions were considered public economic benefits since these earnings represented an increase in national income. Annual benefits after Federal income tax deductions were considered private economic benefits since these earnings represent an increase in personal disposable income. Since the relevance of the vocational training to employment skill requirements did not enter into the calculation of monetary benefits, a relatedness index was developed as a third measure of benefits.

In order to calculate the public cost of vocational education two factors were considered: (1) the quantity of time students spent in a vocational education program (hours of attendance); and (2) the value or cost per unit of time of the services received by individual students. The study included an analysis of nine categories of expenditures to obtain the dollar cost per full-time-equivalent student for each course.

Private indirect costs were measured as a function of two factors: (1) the quantity of time that a student spent in a given vocational education program; and (2) the value or price of time measured by earnings foregone.

Private direct costs used in the analysis included tuition, books, supplies, uniforms, special equipment, and transportation.

Linear equation models for projecting returns on investment in vocational education were developed. The findings included:

- Rates of return from investment in each of the four selected vocational education programs were positive and significant. These findings suggest that promotion and expansion of vocational education in Florida would be a wise economic investment.

- There were statistically significant differences in the rates of return on investment between different vocational programs. Harris believes varying rates of return are a justification for reallocation of resources among programs.

- There were statistically significant differences in rates of return on investment between secondary and postsecondary vocational education.

- On the average, student costs of vocational education are greater than public costs. In order to provide students with information necessary for allocating their resources, it is suggested that summaries of studies such as this be provided to students and guidance counselors.

Hu, T. Studies of the Cost-Efficiency and Cost-Effectiveness of Vocational Education. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1980.

Hu summarizes the major concepts in cost-efficiency and cost-effectiveness analysis and reviews the major findings of past research in these areas. He defines cost-efficiency studies as those involved with determining the optimal distribution of inputs in order to minimize costs. Cost-effectiveness analysis, which is used interchangeably with cost-benefit analysis, examines the relationship between program costs and outcomes.

Among the technical concepts briefly presented are expenditures versus costs, average versus marginal costs, joint costs, opportunity costs, wages versus earnings, non-economic benefits, discount rates, and transfer payments. However, the major contribution of this paper is the review of existing cost-efficiency and cost-effectiveness analyses, primarily those performed after 1970.

Hu, T., Lee, M. L., Stromsdorfer, E. W. and Kaufman, J. J. A Cost-Effectiveness Study of Vocational Education. University Park, PA: Pennsylvnia State Univeristy, Institute for Research on Human Resources, 1969.

This study compares the costs of vocational and comprehensive secondary education, and the labor market performances of graduates of these schools who did not attend college. Measures of labor market performances are average monthly before-tax earnings for a six-year period following graduation and the percent of time employed during that same period. Earnings before taxes are considered a social benefit since the incremental increase in before-tax earnings which are due to the investment in vocational or comprehensive education represents an explicit measure of the monetary returns to society.

Data were obtained from the responses of 2,767 mail questionnaires sent in 1966 and 1967 to graduates of high schools in Philadelphia, Detroit, and Baltimore. Multiple regression analysis was used to measure the net effect of curriculum on the labor market performances for the two types of graduates while controlling for the effects of confounding variables such as socioeconomic characteristics.

In comparing the costs and returns of the two types of high school education, a cost analysis was first performed using the capital recovery factor. The authors assumed an average building life was 60 years and used social discount rates of six and ten percent. The total (capital and current) costs were related to average daily attendance (ADA). The difference in opportunity costs among vocational and comprehensive graduates while they were attending high school was assumed to be negligible.

Monetary returns for high school graduates were obtained through a regression analysis. Net present value, benefit-cost ratio, and rate of return were calculated for vocational and comprehensive education students.

The authors concluded that among students who do not attend college, the monetary returns of vocational graduates are higher than those of comprehensive high school graduates. The authors noted, however, that it is necessary to estimate earnings and employment equations separately on the basis of sex and race to obtain accurate distinctions. Also, the earnings differential may be disappearing as these graduates move along with lifetime earnings profiles. Nevertheless, investment in vocational education is economically efficient, if money costs and benefits are relatively complete indexes of total economic costs and benefits. Finally, the authors note that the study ignores all non-economic costs and benefits of the two types of secondary education, although it is recognized that these non-economic factors are important in any analysis of the total impact of education.

Ittner, F. E. Project to Develop a Cost-Benefit Model for Vocational Programs at College of Alameda (Final Report). Los Angeles, CA: University of California, Clearinghouse for Junior College Information, 1972.

This report describes a pilot study on the development of a cost-benefit model for vocational education programs at the postsecondary level. The model was applied to three vocational programs at the College of Alameda, California - Business Equipment Technology, Dental Assisting, and Diesel Mechanics. Data were gathered through a survey of the five graduating classes from 1968-1972.

A flexible model was designed so that it may be used to compare the relative effectiveness between programs within the same college or at different colleges. Costs were broken down by direct and indirect categories. Included in the cost calculation was the cost of classroom space and depreciation of equipment. Benefits were assumed to be the increased earnings of the vocational graduate as compared with his/her earnings before the schooling, or with the average earnings of his/her cohorts in the area served. These costs and benefits were categorized for the student, institution, and community.

An increase in income was calculated for the vocational graduates. However, th increase was quite small. The report points out however, that over a longer period of time graduate earnings may increase sharply. Ittner suggests that a careful analysis of the initial wages plus the wages earned after a period of time, turnover of jobs, and job satisfaction should be an important part of future analyses of the effectiveness of vocational programs.

Kaufman, J. and Lewis M. The Potential of Vocational Education: Observations and Conclusions. University Park, PA: The Pennsylvania State University, Institute for Research on Human Resources, 1968.

This report is a general discussion of vocational education through data obtained in studies of three cities in Pennsylvania. It focuses upon the extent of vocational programs in schools, the modification of these programs to meet student and employer needs, and the overall strengths and weaknesses of the programs. The study also obtained information on the vocational education graduate's evaluation of his/her training and experience in employment and raises the question of whether the extra costs of these programs produce sufficient benefits to maintain the programs. Data were collected from school records, census data, and supervisors' evaluations of graduates' job performance. The authors conclude that students need a more thorough orientation to vocational training than they currently receive in order to benefit from the vocational program and career options available.

Koch, J. V. A Benefit-Cost Analysis of Vocational-Occupational Training at Selected Illinois Junior Colleges. Springfield, IL: Illinois State Advisory Council on Vocational Education, 1972.

This report presents the findings of a cost-benefit analysis of vocational training at the junior college level in Illinois. Utilizing cross-sectional survey data collected from graduates of five junior colleges, Koch estimated that the private rate of return to the vocational student of technical training was 12.3 percent and the social rate of return was 8.9 percent.

Koch begins the report with a very brief overview of literature in the vocational evaluation field. Three studies are specifically reviewed: Hardin, Noscow, and Borus (1971), Gubins (1972), and Carroll and Ihnen (1966).

Koch then introduces eight issues which need be considered when performing a cost-benefit analysis. He comments that: (1) vocational-occupational training graduates would have earned certain incomes even if they had not obtained a degree; (2) a large proportion of the observed income differential between vocational training graduates and high school graduates may not be due to increased education but rather to greater motivation and ability; (3) individuals enter and leave the labor force periodically and therefore do not earn the income which is reported for their peers in some years; (4) some education and training is viewed by students as being a consumption expenditure rather than an investment expenditure; (5) large intergenerational effects and externalities may be caused by education and training which are not captured by income data; (6) increased incomes are vulnerable to increased tax payments; (7) many jobs have non-monetary aspects such as vacation time, insurance, and other benefits; and (8) cross-sectional data may result in misleading results. In light of these considerations, Koch modified (in a not entirely satisfactory manner) the typical rate of return formula.

Three types of cost were calculated and summed in the analysis to produce a total cost value. These cost components were: (1) direct costs paid by students; (2) direct costs paid by society (e.g. faculty salaries, equipment, etc.); and (3) income foregone by the students. Benefits were calculated as the difference between the income of the vocational graduate and the median income of non-vocational high school graduates. This value was then reduced by 25 percent to reflect differences in ability and motivation. Utilizing this methodology, Koch arrived at his estimated rates of return. The rate of return is greater for the vocational student than society as a whole because the direct costs of school incurred by society are not considered in the calculation of the vocational graduate's rate of return.

Marson, A. A., Weiner, A. E. and Sorenson, R. P. Cost-Benefit Model Development. Cost-Benefit Study (Final Report). Fond du Lac, WI: Lakeshore Technical Insitute and Moraine Park Technical Insitute, 1978.

This report details the findings of a three year study by the research departments at Moraine Park and Lakeshore Technical Institutes. The major emphasis of the report was to examine the non-monetary benefits of a vocational-technical adult education (VTAE) program.

Five vocational training programs were examined. School records were reviewed to obtain the cost of offering each program. Two similar survey forms were developed and sent to VTAE graduates from these five programs and a sample of academic high school graduates. Data from these two sources were analyzed to compare costs and benefits.

Costs and benefits were related by calculating the net present value, the benefit-cost ratio, the average rate of return, and the duration of the payback period. These calculations were performed for both the student and society as a whole.

The following conclusions were reached as a result of the analysis:

- From an economic viewpoint, the benefits of a vocational-technical education to society and to the students themselves are greater than the costs of offering the education to the student.
- VTAE students score higher on tests of study habits and attitudes than do high school students.
- There is a correlation between attitudes (study habits) and program success.
- Both high school graduates as well as VTAE graduates have positive attitudes toward education and toward employment as well as positive degrees of self-acceptance. Little evidence exists to show that a vocational-technical education per se has any effect on these three attitudes.
- Vocational-technical school graduates receive much more help from their school in finding a job than do high school graduates.
- More VTAE graduates are employed in a position they consider permanent within two years after their graduation than are high school graduates.
- Vocational-technical graduates enjoy more job satisfaction than do high school graduates.
- A vocational-technical education does affect the student's personal as well as family life. However, two-thirds of the graduates surveyed stated that they weren't greatly hampered in spending time with family and friends.

- A vocational-technical education has little effect in motivating students to become involved in social and/or community organizations. They seem to participate in such organizations to the same degree as the general public.

- VTAE graduates receive more promotions on the average than do high school students entering directly into the labor market.

- High school graduates find a job faster following their graduation than do VTAE graduates.

- There are several personality traits and/or abilities which a greater percentage of VTAE graduates feel they have than do high school graduates. They include: academic ability, drive to achieve, idealism, mechanical ability, and resourcefulness.

- Vocational, technical, and adult institutes do a good job in the placement of graduates. However, in the present study and in many related studies, VTAE graduates are continuing their education either at another vocational school or at the college level. They feel that more can and should be done for students like themselves who plan to continue their education rather than look for a job.

Mertens, D. M., McElwain, D., Garcia, G. and Whitmore, M. The Effects of Participating in Vocational Education: Summary of Studies Reported Since 1968. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1980.

This report summarizes 232 studies on the effects of participating in vocational education in order to determine whether there are consistent findings across studies for certain selected variables. Seventeen variables were used and the studies were limited to the years 1968 to 1979. Postsecondary and secondary programs were reviewed separately.

The findings focus on the relationship between education and employment. They include: no difference was found in unemployment rates for vocational and non-vocational secondary graduates, although postsecondary vocational graduates had lower unemployment rates; a majority of all vocational graduates find jobs in training-related areas. Other findings relate to earnings, basic skill attainment and academic abilities, further education, and level of satisfaction with training.

Sparks, D. A Synthesis of Research Findings Which Describe Selected Benefits and Outcomes for Participants in Vocational Education. Washington, DC: U.S. Office of Education, Bureau of Occupational and Adult Education, 1977.

This study identifies and explores the benefits of vocational education. It examines the experiences of vocational graduates in an effort to clarify how well vocational training serves its participants.

The methodology employed includes a literature search using post-1970 ERIC indices, an examination of evaluation studies housed at the Bureau of Occupational and Adult Education, and contacts with persons familiar with vocational research.

The studies show that vocational graduates generally do as well as, or better than, graduates of other curricula. Furthermore, vocational programs serve students from a lower socioeconomic background, a population that in general receives fewer benefits from academic or general education. Finally, in examining benefits, the author questions why vocational programs must constantly justify themselves by providing precise data to show that they benefit students in tangible, economic ways.

Swanson, A. D. A Study of the Costs, Benefits, and Effectiveness of Occupational Education. Buffalo, NY: State University of New York, 1976.

This paper describes the methodology, findings, and conclusions of an eight year longitudinal study of the costs, benefits, and effectiveness of occupational education offered in a Board of Cooperative Education Services (BOCES) district. The objectives of the study were to:

- Calculate and compare the costs per pupil for vocational programs offered by a regional school district in the metropolitan area of Buffalo, New York, with the costs of other programs offered by other regional districts of the same metropolitan area.
- Compare the success of graduates of vocational programs, measured by employment, earnings, and selected non-monetary considerations, with the performance of non-college bound graduates of academic high schools.
- Calculate benefit-cost ratios for vocational programs.
- Develop decision matrices for evaluating the likely cost and effectiveness of alternative approaches for meeting district objectives for occupational education.

The study consisted of three phases. First, costs per pupil for the 1972-73 school year were computed for the 16 occupational programs offered by BOCES. Second, economic and noneconomic information on graduates of both BOCES and regular high school programs were gathered from school records and through a mail/telephone survey. Two instruments were used: the School Record Form and the Alumni Survey Form. Third, comparative costs, cost-benefit ratios, and cost-effectiveness ratios were computed for both BOCES and academic high school programs.

Among the study's conclusions were that costs and cost-benefit ratios varied by program area within the BOCES district. In particular, the returns to investment in many high cost vocational programs were negative. In addition, the study found that earnings for male BOCES students were slightly higher than for non-BOCES students. However, the earnings were not high enough to compensate for the greater program costs. Female BOCES students earned somewhat less than non-BOCES students. However, this difference was attributed to socioeconomic and school achievement factors and not to type of training.

Taussig, M. K. "An Economic Analysis of Vocational Education in the New York City Schools." Journal of Human Resources 3 (1968): 59-87.

Taussig presents the findings of his cost-benefit study of vocational education in New York City based on data through 1965. He focuses upon the employment experience of graduates from city vocational schools. Taussig's research is an example of some of the early cost-benefit studies that found that vocational training did not increase the market productivity of the graduates despite the large incremental costs of vocational training. He further suggested that the schools' criteria for measuring program success are largely irrelevant from a public interest viewpoint.

VOCATIONAL EDUCATION

DATA SOURCES

Brown, L. III, Barnes, R., Currence, M. and Henderson, D. Research Data Resources in Vocational Education: An Assessment. Washington, DC: U.S. Department of Education, Office of the Assistant Secretary for Planning and Evaluation, 1980.

This paper presents a review of past and current research and data collection activities in vocational education. Studies reviewed were limited to those performed or sponsored between 1972 and 1980 by the Department of Health, Education, and Welfare. The paper discusses 48 studies specifically. These studies were selected on the criteria of being relevant, objective and unbiased, reliable, based on systematic information, and capable of generalization. These 48 studies may be divided into six broad issue areas: (1) access, including sex equity; (2) funding, especially Federal level to state level disbursements; (3) planning and management, including state and local compliance with Federal statutory and regulatory requirements; (4) quality and effectiveness, primarily in terms of student economic and educational outcomes; (5) education and work, including CETA linkages with schools; and (6) general/miscellaneous studies.

Of particular importance to potential cost-benefit study teams is a review of data resources which could be utilized in vocational education studies. The report considered five data resources to be of superior value. They are: (1) the High School and Beyond Longitudinal Survey; (2) the National Longitudinal Survey - 1979; (3) National Longitudinal Study of the High School Class of 1972; (4) Berkeley Survey of Vocational Schools in 10 states; and (5) the 1966 National Longitudinal Survey. The report cited deficiencies in the Vocational Education Data System (VEDS) data as well as the BOAE annual statistical reports. The major problems with VEDS are: (1) the lack of a standard definition of program enrollees; (2) the absence of information on program duration and length of classroom exposure; and (3) the lack of comparison standards for interpreting reported outcomes.

Brown, L. III and Gilmartin, K. J. Report #1. Measures of Participation in Vocational Education: Enrollments, Students and Exposure. Washington, DC: U. S. Department of Education, Office of Planning and Budget, Office of Technical and Analytical Systems, 1980.

This study, prepared to coincide with Congressional consideration of reauthorizing the Vocational Amendments of 1976, critically reviews the official enrollment statistics published annually by the Bureau of Occupational and Adult Education (BOAE). The review is performed by comparing the BOAE data with the National Center for Education Statistics (NCES) data collected in a 1972 survey of vocational education students in secondary schools. The analysis discusses several vocational education accounting concepts and reporting procedures that affect the interpretation of official data for projected enrollments and future funding. Specifically, the report criticizes the BOAE data for overestimating participation in secondary school vocational programs. For example, the practice of reporting course enrollments rather than number of students can overstate by over one million the number of unduplicated program students.

The implication of the analysis is that the reduced number of vocational students will increase the estimated cost per student. Costs per full-time equivalent vocational student will be approximately three times higher than per student costs for non-vocational secondary programs.

The report provides an excellent analysis of appropriate measures of participation in vocational education programs. The authors propose a measure of participation which would account for: (1) duplication arising from a student enrolled in more than one vocational class or enrolled in a class that is part of two vocational programs; (2) number of hours of class time; and (3) the "lifecycle" of a vocational program. The authors assert that because of major differences in patterns of educational exposure for vocational program areas, studies of vocational education's effectiveness should concentrate on individual programs rather than analyze averages computed over a heterogeneous set of training programs.

Ghazalah, I. A. "Economic Performance of Vocational Education Graduates: A Study Based on U.S. Individual Income Tax Data." The Journal of Vocational Education Research (1981): forthcoming.

The major objective of the research reported in this article is to devise ways to utilize existing data to analyze the impact of vocational education on the performance of its graduates. Most current research uses earnings and other related data collected through personal surveys as a measure of vocational benefits. Ghazalah shows how data taken from U.S. individual tax returns filed with the Internal Revenue Service (IRS) can provide a less costly and more timely alternative to survey data.

The author displays an application of these data by studying 10,731 eleventh and twelfth grade vocational graduates who took the Ohio Trade and Industrial Education Achievement Test in 1971. He uses the IRS income data as a source of information on these students' earnings as well as a proxy for their employment rates (the number of students filing tax returns) and their interregional mobility (the number of students filing tax returns in 1974 by region versus the number of vocational students in 1971 by region).

Golladay, M. A. and Wulfsberg, R. M. The Condition of Vocational Education: Review Edition. Washington, DC: National Center for Education Statistics, 1980.

This report was prepared to supplement testimony to the Subcommittee on Elementary, Secondary, and Vocational Education, Committee on Education and Labor, U.S. House of Representatives. The report characterizes vocational education's providers, offerings, students, facilities, instructional staff, and finances.

The report also presents statistical tables regarding the condition of vocational education. Many of the tables were previously unpublished. These include tables related to institutional providers of vocational education, enrollments, profiles of students, staff, facilities, allocations and expenditures, costs facing vocational students, and outcomes of vocational education.

Grasso, J. T. and Shea, J. R. "Effects of Vocational Education Programs: Research Findings and Issues." The Planning Papers for the Vocational Education Study. Washington, DC: National Institute of Education, 1979.

This is an overview of existing data bases, vocational education evaluations, and cost-benefit study findings. Grasso and Shea begin by synthesizing the data and research based on the results of four national longitudinal surveys: Project Talent, Youth in Transition, the National Longitudinal Surveys, and the National Longitudinal Study of the High School Class of 1972.

They then summarize various vocational evaluation and cost-benefit study findings for the data bases by subject area. Findings are reported on vocational students' socioeconomic status and innate ability, educational aspirations, attitudes towards school, occupational goals, career choices, post-school training, economic success, and psychological capability.

Hopkins, C. O. Data Sources for Vocational Education Evaluation. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1979.

This paper summarizes the informational needs, potential data sources, and data deficiencies for evaluation of vocational education programs. The primary sources for evaluation data are: Bureau of Labor Statistics, Bureau of Census, state employment security agencies, National Center for Education Statistics and state management information systems. The paper includes two informative appendices. The first describes major sources of data by broad data element needs. The second gives more detailed information concerning availability of specific information needs.

Kay, E. R. (ed.). Enrollments and Programs in Noncollegiate Postsecondary Schools, 1978. Washington, DC: National Center for Education Statistics, 1979.

This resource is a compilation of statistics, figures, and tables on the number of students preparing for technical careers in noncollegiate postsecondary schools. The text is divided into separate findings for correspondence schools and noncorrespondence schools. The data were collected from a sample of schools in conjunction with the development of the Directory of Postsecondary Schools with Occupational Programs.

Lee, A. M. Use of Evaluative Data by Vocational Educators. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1979.

In this paper, Lee notes that considerable research exists on approaches to and procedures for evaluation research in vocational education. However, very little has been written on the use of the research by vocational educators. This paper is intended to provide some scholarship in this area.

He first describes conditions that govern the use of vocational data. These include availability, reliability, credibility, and utility. Lee then discusses potential and actual uses of evaluative data by vocational educators and the effectiveness in the use of these data. He concludes by making five recommendations for the further use of evaluative data.

Lee, A. M. "The Vocational Education Data Base." The Planning Papers for the Vocational Education Study. Washington, DC: National Institute of Education, 1979.

This paper surveys the availability and quality of vocational education data on the local, state, and federal levels. Lee suggests that the primary failing of existing data is incompatibility. This incompatibility is the result of such factors as lack of quality control at the federal level, unstandardized definitions of course enrollment and curriculum, variations in the automated reporting capacities of states and localities, and the time delay between the school year and data availability.

Lee writes that two major elements in improving data consistency, and thereby data quality, can be federal reporting requirements and the further development of automated information systems. However, there are a number of obstacles to the potential impact of federal reporting:

- Many states are unwilling to let the federal government dictate data elements and data format.
- Various political ramifications may undermine the intentions of reporting systems.
- Inadequate funding and staff prevent maintenance of reporting quality.

Pucell, D. J. Longitudinal Methods as Tools for Evaluating Vocational Education. Columbus, OH: Ohio State University, National Center for Research in Vocational Education, 1979.

This paper presents the advantages and disadvantages of using longitudinal methods of evaluating vocational education. The literature review for this paper indicates that longitudinal methodologies have not been often utilized by vocational educators. The author suggests that this method would be most useful in answering questions such as:

- Does vocational education make a difference?
- What program practices increase the possible success of vocational graduates?
- What are the additional costs of preparing special needs students for employment?

Longitudinal data bases generated on a continual basis would allow educators to ask questions and examine relationships which would more readily provide information on the impact of program changes upon students.

Woods, E. M. "National Longitudinal Studies and Data Sets." VocEd 55 (September 1980): 35-38, 63.

In this article, Woods has identified several common methodological concerns regarding the use of longitudinal data. Five national longitudinal data sets are specifically reviewed regarding their relevancy to an evaluation of vocational education. These data sets are: Project Talent; Youth in Transition; National Longitudinal Surveys; National Longitudinal Study of the High School Class of 1972; and National Longitudinal Survey (new cohort).

Several limitations were noticed in a cross comparison of the selected data sets. Since each data set was collected with different objectives in mind, the sample size and type varies. Also, vocational programs have changed between the oldest study (1960) and the newest study (1979).

Woods also discusses potential sources of discrepancies in defining a vocational student and course of study. First, students and administrators may have varying perceptions of the kind of program in which the student participated. Program classifications differ according to the researcher's approach as well. The tendency to group all vocational programs in the same category without regard to quality, content, duration, and intensity is also a problem.

In reviewing program outputs, Woods empahsizes the need to control for differences in student background and other variables. The problems in over-aggregation are also noted. Becasue of the dificiencies in the available data, Woods asserts that "we should probably not even try to estimate effects, but instead, in accordance with the limitations of the available data, merely estimate outcomes associated with different kinds of vocational education."

SECTION 4

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SECTION 5

GLOSSARY

Adult Education - Basic instruction for adults that may be provided by a school system, college, or other institution but is usually apart from the regular matriculating program.

Area Vocational School - A public school approved by a State Board of Vocational Education to provide occupational training to residents of the state, county, city, or other geographic area usually larger than the local basic administrative unit.

Average Cost - The toal cost of a program divided by the number of units produced or consumed.

Average Daily Attendance (ADA) - The sum of each day's attendance during the school year divided by the total number of school days.

Average Daily Membership (ADM) - The sum of each day's enrollment during the school year divided by the total number of school days.

Benefit - A consequence or outcome of the educational process measured in monetary or non-pecuniary terms.

Capital Costs - Costs incurred for the purchase of capital equipment (e.g. machinery, buildings, etc.)

Career Education - Planned education experiences by which one prepares for a career.

Comprehensive High School - A secondary school offering diversified curricula such as academic, industrial, business, and/or vocational programs.

Consumption - The use of resources purely for immediate personal gratification and not for future income gains.

Cooperative Education - A combined program of school instruction and on-the-job training.

Cost - A monetary or non-pecuniary unit that is incurred in obtaining an outcome or consequence.

Cost-Benefit Analysis - An analytic framework in which the cost and benefits of a project are compared.

Cost-Benefit Ratio - An analytic tool used in cost-benefit analysis which relates costs and benefits by dividing total benefits by total costs.

Cost-Effectiveness Analysis - An analytic framework which relates program costs to a quantified level of effectiveness.

Direct Costs and Benefits - Costs and benefits resulting directly from participation in or conducting of a program.

Discount Rate - A factor which "discounts" future earnings and costs to a present value.

Disposable Income - Total income after taxes.

Dual Enrollment - An arrangement where a student concurrently attends two schools part-time such as a secondary school and an area vocational school. This is also called shared time.

Earnings - Money earned through labor rather than investments.

Earnings Multiplier Effect - The interactive chain of increased earnings that results from one individual receiving an increase in disposable income and spending part of that increase which, in turn, increases the income of another individual, etc.

Educational Inputs - Inputs used in the process of providing an education (e.g. teachers, books, buildings, etc.).

Educational Outputs - Outputs resulting from the educational process (e.g. knowledgeable students).

Externality - The result of an economic action that affects individuals (positively or negatively) not directly involved in the transaction.

Forgone Income - The potential income that is given up by an individual while attending school.

Full-Time Equivalent (FTE) - A measure of the equivalent number of full-time students in a school. It is calculated by determining the number of classroom hours for a full-time student and summing the proportions of this figure for all students.

Holding Power - A measure of student retention represented by the percentage of students who remain in a program. Therefore, this is the inverse of the dropout rate.

Income - Money earned through labor, investments, etc.

Indirect Costs and Benefits - Costs and benefits that are an indirect result of participating in a program.

Investment - The use of resources to increase future levels of income or consumption.

Joint Costs - Costs associated with an educational input that are used by more than one student cohort group.

Longitudinal Data - Information collected on students or individuals over time.

Management Information System (MIS) - A reservoir of data that usually is accessed by computer. The system may be used to make efficient expenditure decisions or to compare the effectiveness of alternative policies.

Manpower Training - Job oriented or vocational training normally provided outside of formal school settings.

Marginal Costs - The addition to total cost of a unit increase in output.

Net Present Value - An analytic tool used in cost-benefit analysis that represents the difference between the present value of the benefit and cost streams.

Non-Pecuniary Costs and Benefits - Costs and benefits generally not quantifiable in monetary terms.

Opportunity Costs - The value of using an activity's inputs for an alternative purpose.

Postsecondary Education - Instructional programs provided for students who have completed elementary and secondary school programs.

Private Benefits and Costs - Benefits and costs accruing to the student receiving educational training.

Production Function - An analytical tool that relates quantities of inputs to one or more outputs.

Productivity - The measure of output per unit of input.

Proprietary School - A private or non-public school which operates as a business for profit.

Public Good - An item which everyone may enjoy and not be excluded from its benefits. An often-used example is national defense.

Rate of Return - A percentage calculation indicating the economic return on investment.

Regression Analysis - A statistical technique which relates a dependent variable to a group of independent variables.

Shadow Price - The price attributed to a good or service by an evaluator when, from the viewpoint of the evaluator, the good or service is not appropriately priced, due to externalities or other market inadequacies. This is also known as accounting price.

Social Benefits and Costs - Benefits and costs accruing to society as a result of a student receiving educational training.

Student-Unit - A unit of measure generally used as the primary measure of student participation.

Technical Institute - An institution offering instruction primarily in one or more technical fields at the postsecondary level.

Vocational Education - Education in one or more semi-skilled, skilled, or technical occupations.

Vocational Rehabilitation - The service of preparing disabled persons for employment through diagnosis, guidance, training, and placement.